Names:

School:

2001 UTAH SCIENCE OLYMPIAD - PHYSICS LAB

OPTICS STATION 1: REFRACTION AND REFLECTION - PART 1

There are two parts to the **REFRACTION AND REFLECTION** competition. Both parts must be completed within a time of **20 minutes**.

Equations and values: $n_1 \sin \theta_1 = n_2 \sin \theta_2$ $n_{air} = 1$

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You do not have to complete PART 1 in order to do PART 2.

PART 1: Use the optical bench provided to determine the index of refraction of the cylindrical lens. The light should enter the center of the flat side of the lens; do not move the lens on the ray table except to make slight adjustments to its position.

Use your value of the index of refraction to calculate (not measure) the critical angle for total internal reflection for the cylindrical lens.

When you are finished with Part 1, turn it in to the event supervisor, and you will be given Part 2.

Show all work and calculations below.

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OPTICS STATION 1: REFRACTION AND REFLECTION - PART 2

There are two parts to the **REFRACTION AND REFLECTION** competition. Both parts must be completed within a time of **20 minutes.**

Equations and values: $n_1 \sin \theta_1 = n_2 \sin \theta_2$ $n_{air} = 1$

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PART 2: Use the optical bench provided to determine the index of refraction of the flat square glass. **Carefully describe your procedure. An answer without a detailed procedure and explanation of your calculations will receive little credit.**

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OPTICS STATION 2: CONVEX LENS - PART 1

There are <u>two</u> parts to the **CONVEX LENS** competition. Both parts must be completed within a time of **20 minutes**. **Don't forget to include units with your answers!**

Equations and values: $\frac{1}{p}+\frac{1}{q}=\frac{1}{f}$ $\qquad \frac{1}{f}=(n-1)\left(\frac{1}{R_1}-\frac{1}{R_2}\right)$

THE SCREEN IS LOCATED AT THE 10 cm MARK ON THE OPTICAL BENCH. DO NOT MOVE THE SCREEN AT ANY TIME.

- -

You do <u>not</u> have to complete PART 1 in order to do PART 2.

YOUR SCORE ON PART 1 WILL ALSO SERVE AS THE TIEBREAKER FOR THE PHYSICS LAB COMPETITION

PART 1: Hold the laser in your hands and, by moving the laser as it shines through the lens and sliding the lens along the optical bench, determine the focal length of the convex lens. **Carefully describe how you moved the laser, and why. An answer without a detailed procedure and explanation will receive little credit. Do not use the light bulb in Part 1.**

When you are finished with Part 1, turn it in to the event supervisor, and you will be given Part 2.

Show all work and calculations below.

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OPTICS STATION 2: CONVEX LENS - PART 2

There are <u>two</u> parts to the **CONVEX LENS** competition. Both parts must be completed within a time of **20 minutes**. **Don't forget to include units with your answers!**

Equations and values: $\frac{1}{p}+\frac{1}{q}=\frac{1}{f}$ $\qquad \frac{1}{f}=(n-1)\left(\frac{1}{R_1}-\frac{1}{R_2}\right)$

THE SCREEN IS LOCATED AT THE 10 cm MARK ON THE OPTICAL BENCH.
DO NOT MOVE THE SCREEN AT ANY TIME.

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Part 2: Mount the light bulb on the optical bench. By sliding the light bulb and lens along the optical bench, determine the focal length of the convex lens. Arrange the positions of the bulb and lens so your answer is as accurate as possible. **Do not use the laser in Part 2.**

Use your value of the focal length and the radius of curvature of +23 cm for each side of the lens to calculate the index of refraction of the glass that the lens is made of.

Show all work and calculations below.